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(Illustrated articles are marked with an asterisk.)

THE RUMFORD MEDALS.

The recent presentation of the Rumford medals to an eminent American engineer and inventor, has excited much attention in scientific and mechanical circles, and it seems appropriate to give a brief history of the origin of these medals and the nature of the honor conferred by their award.

Benjamin Thompson, Count Rumford, was born in Woburn, Mass., in 1753. He received only a common-school education, and entered a country store as a clerk at the age of 13. During his clerkship, which lasted some four years, he employed his leisure time in study (more particularly of medicine and physics) to such good purpose that in 1770 he was qualified to teach an academy in the town of Rumford, N. H., now Concord, the capital of the State. Two years later he married a wealthy widow, and also received a commission from the Governor of New Hampshire creating him major in the militia. Through personal jealousy on the part of older officers, he was charged with disaffection to the cause of the American colonies which resulted in his leaving Rumford for Woburn, and soon after the latter place for Boston.

He was subsequently tried at Woburn, and although not fully condemned, was neither fully acquitted. He finally left the American lines, and when Boston fell into the hands of the British, he became the bearer of dispatches to England containing the announcement of that event.

Remaining in England he became the secretary of Lord George Germain, at that time Secretary of State for the Department of the Colonies. He subsequently returned to America and raised a regiment of dragoons, receiving the rank of lieutenant-colonel. Again visiting England, and hostilities being at an end, he obtained leave of absence and traveled in Europe. Finally, settling in Munich, he interested himself in military and social improvements and reforms, performing important services, in consideration of which he received his title of Count Rumford, the latter part of the title being chosen by himself. Shortly after, his health being impaired, he traveled in Italy, and finding that he did not improve he visited England.

For a long time previous he had made the subject of heat a special study; and while he remained in England he continued his investigations with highly practical and beneficial results.

Returning to Bavaria, and finding that the climate still disagreed with him, he ultimately settled in Paris, where he spent the remainder of his life. He died Aug. 21, 1814.

His time in Paris was mostly devoted to scientific and philosophical inquiries and investigations. The most important of his investigations were upon the relation of heat to friction, and the experiments he performed were among the most remarkable of all those from which the basis of the modern theory of heat has been derived.

Some time previous to his death he instituted prizes for discoveries in heat and light. These prizes, consisting of a gold and a silver medal, were to be awarded by the Royal Society of London and the American Academy of Sciences. Their intrinsic value is $300, and they are only to be given by the American Academy of Sciences to authors of improvements or discoveries in heat and light, in any part of the continent of America or of the islands of America—preference always being given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind. To this end Rumford donated the sum of $5,000 to this institution July 12, 1796.

At a late meeting of the Academy this prize was bestowed upon Mr. G. H. Corliss of Providence, R. I., for his improvements in the steam engine. The award was made by Dr. Asa Gray, in a very appropriate address in which the merits of Mr. Corliss' improvements and inventions were ably stated and which was very briefly, but gracefully replied to by Mr. Corliss, in accepting the medals.

This is the fifth medal awarded by the Academy, the recipients, and their discoveries and inventions being as follows, in the order stated:

1. Professor Hare, for his oxy-hydrogen blowpipe.
2. Capt. John Ericsson, for his hot-air engine.
3. Professor Treadwell, for his improvements in the construction of ordnance.
4. Mr. Alvan Clark, for his new mode of grinding and perfecting large lenses.
5. Mr. George H. Corliss for his improvements in steam engines.

We congratulate Mr. Corliss on the receipt of this high and well-deserved honor. He has long been widely and favorably known through his inventions, and the appropriateness of the honor conferred will be recognized by all acquainted with his improvements.

SOLUTIONS FOR HARDENING STEEL.

Of all the departments of the mechanic arts probably none is so completely enveloped in superstition and bigotry as that of hardening and tempering steel tools. We have scarcely ever met a man claiming skill in the art who had not some notion upon the subject which *his* experience seemed fully to confirm, or who did not advocate some practice for which he could assign no solid reason. Moreover we never recollect hearing anything recommended as more efficacious than simple water, that some one else would not be found to scout as utter nonsense, but who, at the same time, was a firm believer in something else perhaps even more absurd.

A certain individual, who shall be nameless, tempered stonecutters' implements in cow's urine, and expressed himself as perfectly able to change the character of the steel by using instead the urine of a calf. To our query whether he had ever tried the urine of a jackass, he replied that he had no doubt it had peculiar virtues; and we left him to pursue his experiments "on this line" feeling that many a shining light is hidden by the prejudices of an unbelieving world.

A page might be filled with the record of all the preparations, mixtures, charms, etc., by the use of which success in the tempering of steel has been attempted, and each of which has had its admirers.

A certain virtue has been, by many, supposed to reside in leather shavings, by which, if a tempering fire *be kindled* with them, immunity from cracking is secured; and Byrne states that a man who had tried it told him that, although before its use he was greatly troubled by cracking while tempering, since he had found out the virtues of leather as a preventive, not a single case of cracking had occurred, though he had used it for years.

Argument, of course, would be useless with such an individual; his experience (sic) would weigh with him more than anything that could be said by any one else, though the experience of the latter might have shown the utter worthlessness of the article in which the former placed blind and implicit faith.

The state of things which we have described is scarcely to be wondered at. when we reflect that all knowledge on the subject of hardening and tempering steel is empirical. Nothing is accurately known about it except that when steel is heated and suddenly cooled it becomes hard and brittle, and that by heating it again its hardness and brittleness may be reduced to the degree required, and that this change of character is a molecular change of some kind yet to be determined.

The suddenness of the cooling is of course affected by the rapidity with which the cooling medium conducts or conveys away heat; and any change in the character of the medium which does not increase or diminish its conducting power would certainly seem to have little to support it. Of course the character of the objects to be tempered will indicate in some measure the mode employed. The watchmaker often heats his tiny drills in the flame of a candle, hardens them by sticking them into the cold tallow, and draws the temper by the same flame.

A little salt thrown into the water employed for tempering is quite generally supposed to add to its virtues, but a competent experimenter informs us that in a large number of experiments instituted to test the truth or falsehood of this notion he found nothing to support it.

Thin and small objects, which only need a small degree of hardness, may be advantageously hardened in oil for the reason that it cools them less suddenly, and therefore does not make them so hard as water would, while for large articles requiring to be very hard, quicksilver has been employed with success for precisely the opposite reason.

A recipe for hardening mill picks, which, slightly varied in its proportions, has quite a reputation, is as follows: Two gallons rain water, one ounce corrosive sublimate, one ounce sal-ammoniac, one ounce saltpeter, and one and one half pints of rock salt. The picks to be heated to a cherry red and hardened, and the temper not to be drawn. It is claimed that the salt gives hardness, and the other ingredients toughness to the picks; but no reason why they should do so seems tenable, as there certainly is no chemical reaction in the bath by which these results can be accounted for.

We hazard the opinion that simple water would be just as good, and that for all moderately-sized articles it is just as good as any solution that can be made, though of course in a matter depending so much upon personal judgment as the hardening and tempering of steel, we should not expect any man to succeed perfectly at first with any bath to which he had not become accustomed.

Correspondents frequently ask us to recommend to their use solutions for tempering; but with the views we have stated it will be seen we cannot conscientiously indorse anything of the kind; if given at all it has therefore been generally upon the recommendation of others rather than upon any convictions of our own in regard to the merits of such preparations.

STUDY OF FIRST PRINCIPLES BY INVENTORS.

Let us suppose a man skilled in the use of tools and able to construct what his brain conceives; or at least able to superintend its construction, and get it properly done. Let us further suppose our mechanic to have an inventive mind, capable of striking out new and useful methods of accomplishing work by machinery. Suppose this talent to be so great that its employment in invention is very desirable, and if properly directed, more likely to prove profitable than any other business in which he can engage. Now what kind of knowledge will this man need, in order that his native talent and acquired skill may work untrammeled? We answer he will need first a sufficient knowledge of mathematics to be able to gain a knowledge of first principles; and second, he will need to know the first principles of physics, as well as the first principles upon which modern methods of changing crude materials into finished fabrics are based.

The knowledge of the first principles of physics is necessary not only to render comprehensible the means of transmitting motion and its conversion into work, but also to prevent errors in conclusions in regard to proportions of the parts of machines, and the results which will follow combinations of parts. The knowledge of the first principles upon which modern industries are based is necessary; for, in most cases, these principles must underlie any new method he may be able to devise. Peculiarities of cotton, wool, silk, or linen machinery, originate in the different nature of fibers. Cotton fibers may be readily drawn longitudinally in either direction; wool fibers draw only one way, and need oiling or lubricating in order to be worked; flax fibers will not draw unless wetted; silk fibers are spun to hand by the worms, and are simple threads needing only to be wound, doubled and twisted previous to weaving.

We might go on through all the category of modern industries, and find in each an illustration of the truth that the principles upon which they are based are really first principles, which must be observed in any process designed to supersede them.

Thus the principle upon which sulphur and phosphorus are removed from iron is a fundamental one connected with the very nature of those impurities; namely, their greed for oxygen. And all the methods, from puddling up to the Bessemer, Heaton, and Ellershausen processes, devised to eliminate sulphur and phosphorus from iron, have been based upon the property mentioned. Bessemer puts in oxygen by pumping air into the molten mass; Heaton puts in oxygen chemically combined in nitrate of soda, which, decomposing by heat, liberates its oxygen to combine with the sulphur and phosphorus; Ellershausen puts in the oxygen combined with iron, as found in certain ores; while the old method of puddling consists in stirring the partially melted ore and exposing it to the free oxygen of the air. All these processes rest on a common basis.

The knowledge of first principles comprises what is generally understood by the term theory; and while we are ready to admit that theory alone cannot subserve the purposes of the inventor or the mechanic, we maintain that practice alone will not answer. The truly great inventor gets as much of both as he can.

The inventor should therefore familiarize himself with processes of all kinds, and should first seek to learn the general and fundamental principles which underlie the details, rather than the details themselves; as the details will be far more readily understood and retained in the memory by adopting this method of study, while an intelligent conception of the purpose of each will also be gained by subsequent study.

PUMPING DOWN BUILDINGS.---FALL OF THE DINING HALL OF KING'S COLLEGE, LONDON.

In a recent article entitled pumping down buildings, we alluded to the fall of King's College, London, as an instance of the results to be expected from tapping water bearing strata underlying heavy structures. We have received through our European exchanges further particulars in regard to this event and the causes which led to it, and they strikingly confirm all that we have said in our previous article.

It seems that the cast-iron girders of the building had been weakened by the cutting out of the top flange for convenience in fixing them. This flange, therefore, instead of constituting about half of the whole strength of the girder, became only an additional burden to be supported.

These girders had, however, withstood all strains brought to bear upon them some thirty years, yet when they broke, it was found they cracked at the points where the flange had been cut out, the fracture indicating that the metal was sound up to the time of the building. With the same usage the structure had ordinarily been subjected to, previous to the catastrophe, the building would undoubtedly have stood a century longer.

The prime cause of the fall was, without any doubt, what we stated in our former article. The surface upon which the